HENRY/TEMPO SOLID STATE AMPLIFIERS GENERAL INFORMATION SHEET

TYPE ACCEPTANCE INFORMATION

With the installation of commercial filtering, these amplifiers are type accepted for operation under all applicable parts of land mobile and fixed base station services. However it is the responsibility of the technician installing and tuning the amplifier to hold the proper class of FCC commercial license and to be familiar with the rules and regulations pertaining to the power output permissible under the class of station license the amplifeir is to be used with.

Also, it is extremely important to consult the specifications published by the manufacturer of the exciter. This will insure that the power level which the transceiver will be raised to will not invalidate its full acceptance because of spurious content or frequency stability.

The technician must determine what the maximum power level is in the class of operation he intends to use the amplifier. We suggest that the technician consult the FCC publications regarding the regulations.

For all regulations calling for the measurement of the final input power, consult the sections describing alignment and power adjust on the attatched technical sheet. To comply with any regulation regarding low power capability see the section describing the CONTROL connection.

The content of harmonic spurious signal generated by this amplifier is attenuated far in excess of the FCC requirements for the service that the amplifier is type accepted. The attenuation of these spurious signals is guaranteed in the design of the amplifier as well as by the use of a band pass filter on the output of the amplifier.

UNPACKING AND INSTALLATION

The solid state amplifier you have purchased was tested and aligned at the factory for the frequency you requested. Further alignment may be necessary to match the antenna in you installation. Please read the alignment procedure carefully as described on the technical information sheet. Do not try to realign the amplifier unless the output power is below specifications. The solid state devices in your amplifier are easily damaged if they are serviced incorrectly. The equipment warranty can not cover damages caused by negligent service, therefore we recommend that all service be accomplished by a knowledgeable technician.

Remove the amplifier from its shipping box and packing material and examine it for visible damage. If the equipment has been damaged in shipment, save the box and packing material and notify the transportation company immediately. DO NOT put the amplifier into service if it has been damaged.

The following accessories should be included with the amplifier. A drive cable, a DC cable, an instruction manual, a warranty card, and an RF OUT plug. Special cables or connectors can b supplied on request. When installing the amplifier, keep in mind that the equipment should be mounted as closely as possible to the 13.8 VDC power source to prevent low output caused by a voltage drop in the DC cable. We recommend installation inside the vehicle for mobile installations. The red power lead connects to the battery's positive (+) terminal and the black DC lead connects to the battery's negative (—) terminal. Figure 1 is a diagram of the necessary interconnections.

The DC power cables should be connected directly across the battery to prevent damage to the ignition system of the vehicle caused by the high operating current of the amplifier. Screw the amplifier into position at the location desired and plug the DC power cable into the appropriate connector on the amplifier.

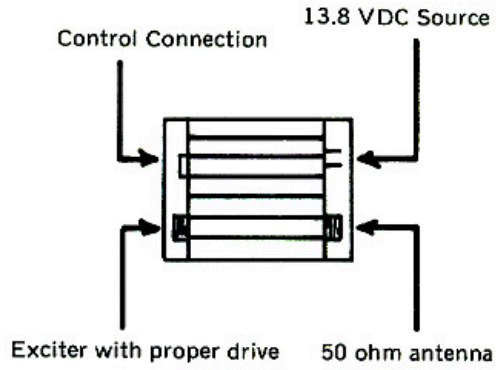
Connect the RF OUT coax connector to an appropriate antenna (50 ohms) using coaxial cable. These amplifiers, as with all solid state devices, operate with maximum output when operating into a 50 ohm load with a low SWR. The SWR of the antenna should be measured and adjusted for a minimum at the desired operating frequency. Also remember that long coax leads cause significant power losses at UHF and VHF frequencies. Connect the supplied drive cable to the exciter and to the RF IN coax connector of the amplifier.

The mobile installation has been completed when all of the described connections have been made.

For base station installations, the amplifier must be connected to a 13.8 VDC source (either a storage battery, or an AC to DC power converter) which is capable of supplying the necessary current.

The amplifiers are designed to key into transmit automatically whenever they are driven with nominal excitation. The CONTROL jack, described on the accompanying sheet, disables the automatic keying circuit for low power operation.

For optimum output, remember that the voltage at the amplifier, the drive power, the length of the coax lead, and proper antenna tuning are all important operating parameters. Complaints of low output can generally be traced to an improper installation.



FOR MAXIMUM OUTPUT POWER

MAXIMIZE YOUR OPERATING PARAMETERS

Figure 1. Installation Diagram.

SERVICE AND REPAIR INFORMATION

Be certain to heed the warnings regarding damage caused by negligent servicing. Be certain to use replacement parts of equal or better ratings when servicing the amplifier.

When ordering replacement or spare parts for your equipment, be sure to specify the model number of the amplifier, the serial number, the schematic number of the part, and a description of the part. This information will aid in fast and correct handling of all parts orders.

Should it become necessary to ship the amplifier to a service center for repair, repack the transceiver in its original carton (or an equivalent box with adequate packing to prevent shipping damage).

After the amplifier has been properly packed, return the equipment to the service center prepaid. Be certain to insure the package for its full value. Also include a short note describing the problems involved. Any amplifier returned for warranty repair should include some proof of the purchase date.

PLEASE NOTE . . . All rated amplifier outputs are measured under laboratory conditions with a proper drive level. If the amplfiiers are operated with improper drive, at a voltage less than 13.8 VDC, with mismatched cables, or with a mismatched antenna, the output will be less than maximum.

HENRY RADIO

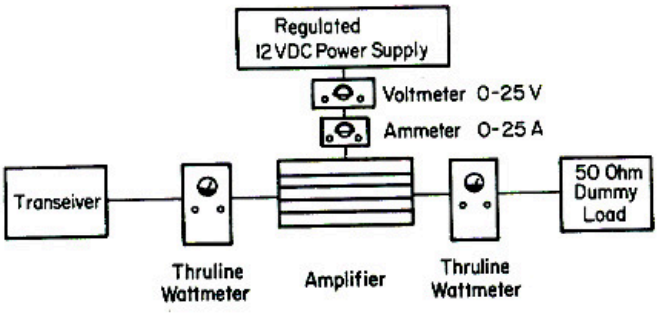


Figure 2. Test Circuit Block Diagram.

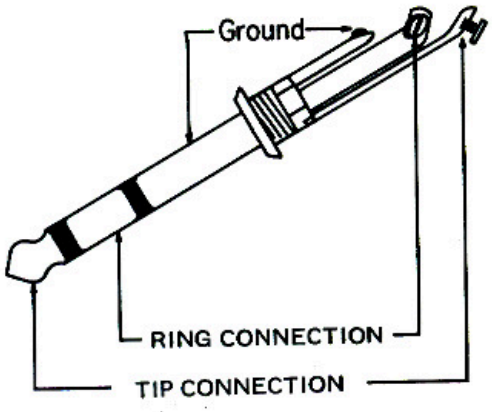
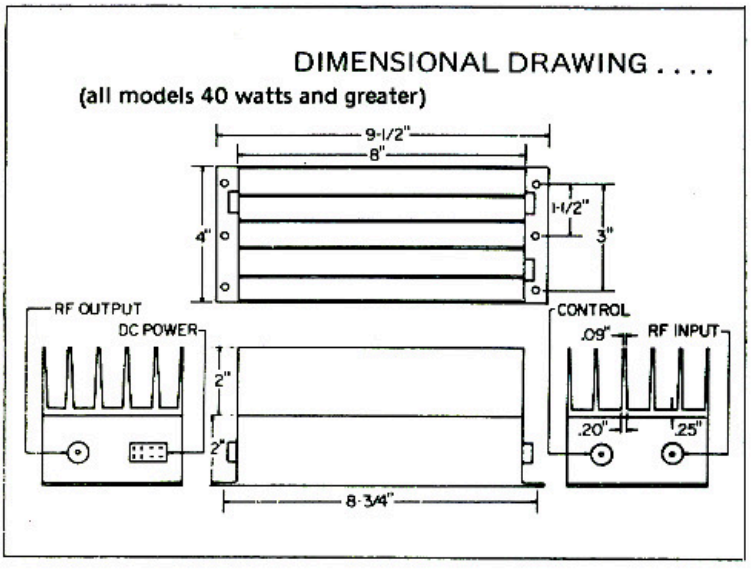
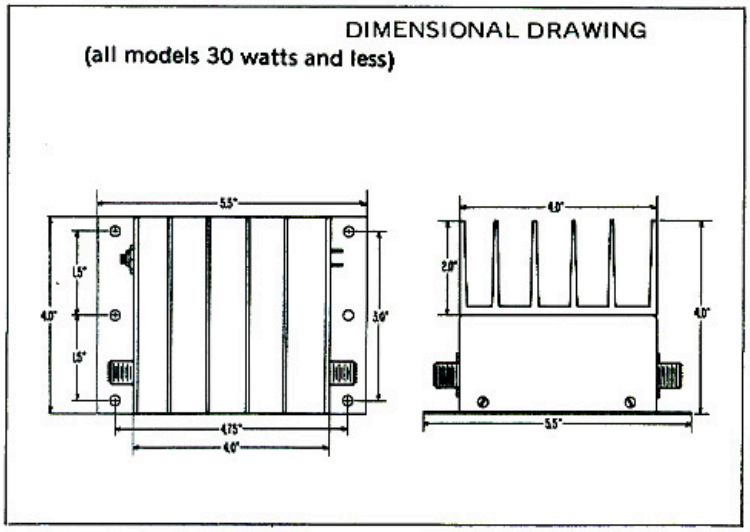


Figure 3. Amplifier Control Plug.





HENRY/TEMPO 50 WATT AND 80 WATT POWER AMPLIFIER INSTRUCTIONS

CIRCUIT DESCRIPTION

MODEL 80A02

The circuit diagram of the 80A02 amplifier is shown in this manual. The amplifier consists of three distinct circuits: An RF sensor and relay circuit, a pre-amplifier stage, and a final power amplifier stage.

In the sensing-relay circuit, RF from the antenna to J3 (RF OUT) goes directly through the relay and J1 (RF IN) into the transceiver during receive. During transmit, the RF from the transceiver enters the amplifier through J1 (RF IN) and creates a DC voltage across diode D1: The voltage is amplified by Q1 to trip relay RY1 causing the signal to enter the amplifier sections. Grounding the base circuit of Q1 disables the sensing circuit to turn the amplifier off. D1 senses the RF output power creating a current at the top portion of J2 (CONTROL) for monitoring of relative output on an external meter.

In the preamplifier section (driver stage), the base of Q2 is matched to 50 ohms by L2, C10, C11, C12, and R5. These components form a pi strip line matching network. L2, like most of the other coils in the amplifier, is printed on the circuit board and is not a replaceable component.

The output power from Q2 (20 to 40 watts) is matched to and divided between the two transistor final output stages Q3, Q4 by L4 and L6, C13, C14, C15 and C 17. C15 and C 17 with printed inductors L4 and L6 form a pi strip-line matching section and a simulated 1/4 wave power divider which is adjustable with trimmers C13 and C14. L3, C4 and C5 are used to decouple the collector of Q2 from the power line.

Power from the final transistor stages is recombined and raised in impedance by L7 and L9, and C18-C20. These components form a band-pass filter which serves to attenuate harmonics more than 50 db below the fundamental carrier level. C8, C9, and L11 serve to decouple the final stage from the supply line.

D4 is a reverse polarity protection diode. The amplifiers are designed to operate from a negative ground system. The amplifiers' boards are glass epoxy.

MODEL 80A10

The 80A10 amplifier is identical to the 80A02 in all respects except for the addition of an attenuator circuit at the input of Q2.

MODEL 80A30

The 80A30 amplifier is basically the same circuit as the 80A02 and 80A10. The difference is the deletion of the driver stage, Q2 and its related components. The drive from the transceiver passes through the relay and enters the amplifier stage at C13.

MODEL 50A02

The 50A02 amplifier is very similar to the 80A02 amplifier.

In the drive stage, Q2 is replaced by a lower power transistor for less drive. In the final amplifier stage, Q3 and Q4 are also replaced by lower power transistors for less output.

MODEL 50A10

The 50A10 amplifier is identical to the 50A02 in all respects except for the addition of an attenuator circuit at the imput of Q2.

C MODELS

All C models are identical to the other amplifiers except for the addition of a 9-pole low pass filter on the output of the amplifier. The filter reduces the output harmonics of the amplifier approximately an additional 55 to 60 db.

TESTING AND ALIGNMENT

MODELS 80A02 and 50A02

> **WARNING: The transistor in these amplifers are easily damaged if they are shorted. An insulated alignment tool is recommended for all service. The equipment warranty can not extend to transistors shorted during service.**

First verify that the RF drive power of the transceiver is proper for the amplifier being used (1 to 4 watts for the A02 modes, 5 to 15 watts for the A10 models, and 20-40 watts for the A30 models.)

Remove the bottom plate of the amplifier, and turn the amplifier upside down, and make all of the interconnections described in the test diagram.

> **CAUTION: The amplifier should be operated into an adequate dummy load whenever it is transmitting.**

(STEP 1) Preset the trimmers as described below. Always use an insulated alignment tool.

C10 1/4 turn less than maximum capacity.
C11 1/8 turn less than maximum capacity.
C13 1/4 turn less than maximum capacity.
C14 1/4 turn less than maximum capacity.
C19 1/2 turn less than maximum capacity.
C20 1/8 turn less than maximum capacity.

These figures are for 146 MHz. For frequencies higher than 152 MHz, calibrate the trimmers about 1/8 turn less than described above.

(STEP 2) Apply nominal drive to the amplifier, and carefully adjust C10 for minimum SWR between the exciter and the amplifier. The adjustment should be very slight.

(STEP 3) Adjust C13, C14, C11 and C10 until there is an increase of the current drawn by the amplifier from the 13.8 VDC source.

> **NOTE: Adjustment of C10 and C11 have a very sharp effect on the input SWR and the output power of the amplifier. Adjust them carefully.**

(STEP 4) Adjust C19 and C20 for maximum output.

(STEP 5) Readjust C13 and C14, and then readjust C20 and C19 for maximum output.

(STEP 6) Readjust C10 and C11 for maximum input SWR and maximim power output.

(STEP 7) Readjust C13, C14, C19 and C20 for maximum output.

(STEP 8) Repeat steps 6 and 7 until the unit meets desired specifications.

MODELS 80A10 and 50A10

The alignment procedure for these models is identical to the procedure described in the section for MODELS 80A02 and 50A02. The only difference would be the drive from the exciter.

MODEL 80A30
Capacitors C10 and C11 are omitted from this model. Follow the alignment procedure described for Models 80A02 and 50A20 found above, but omit the adjustments described for C10 and C11.

SPECIFICATIONS

POWER OUTPUT: 80A models 60 - 80 watts
50A models 40 - 50 watts

FREQUENCY RANGE: 135 - 175 MHz

HARMONIC ATTENUATION:
Better than 70 db below carrier with commercial filtering

POWER REQUIREMENTS:
13.8 VDC nominal
11 to 15.5 VDC possible
5 ma nominal - standby
130A . . . . . 18 amps nominal max.
80A . . . . . 14 amps nominal max.
50A . . . . . 9 amps nominal max.

INPUT - OUTPUT IMPEDANCE:
50 ohm unbalanced nominal

ANTENNA CHANGEOVER:
Automatic built-in RF sensing

MONITOR:
Remote relative RF output

DRIVE REQUIREMENTS:
A30 models 20 - 40 watts
A10 models 5 - 15 watts
A02 models .8 - 4 watts

BANDWIDTH: Approximately 4 MHz without retuning

DUTY CYCLE: 50 % with no external cooling
100 % with external cooling

TYPE OF EMISSION: FM

MISMATCH PROTECTION: Balanced emitter transistors will withstand infinite VSWR

CONTROLS: Remote off

DIMENSIONS: 9.5" long x 3.5" high x 4" wide

CONTROL AND MONITOR CONNECTION

A dual function control jack is provided on each amplifier to allow remote control and power output monitoring of the amplifier.

As shown, grounding the control line disables the amplifier, connecting the transceiver directly to the antenna. To monitor the relative output power, connect a DC voltmeter or milliameter between ground and the tip of the control plug.

TEST DATA

MODEL _____

SERIAL NUMBER _____

TUNED FREQUENCY _____

TYPE ACCEPTANCE NUMBER _____

OUTPUT: _____ **watts with** _____ **watts drive at 13.8 VDC**

_____ _____

DATE **TECHNICIAN**

POWER ADJUST

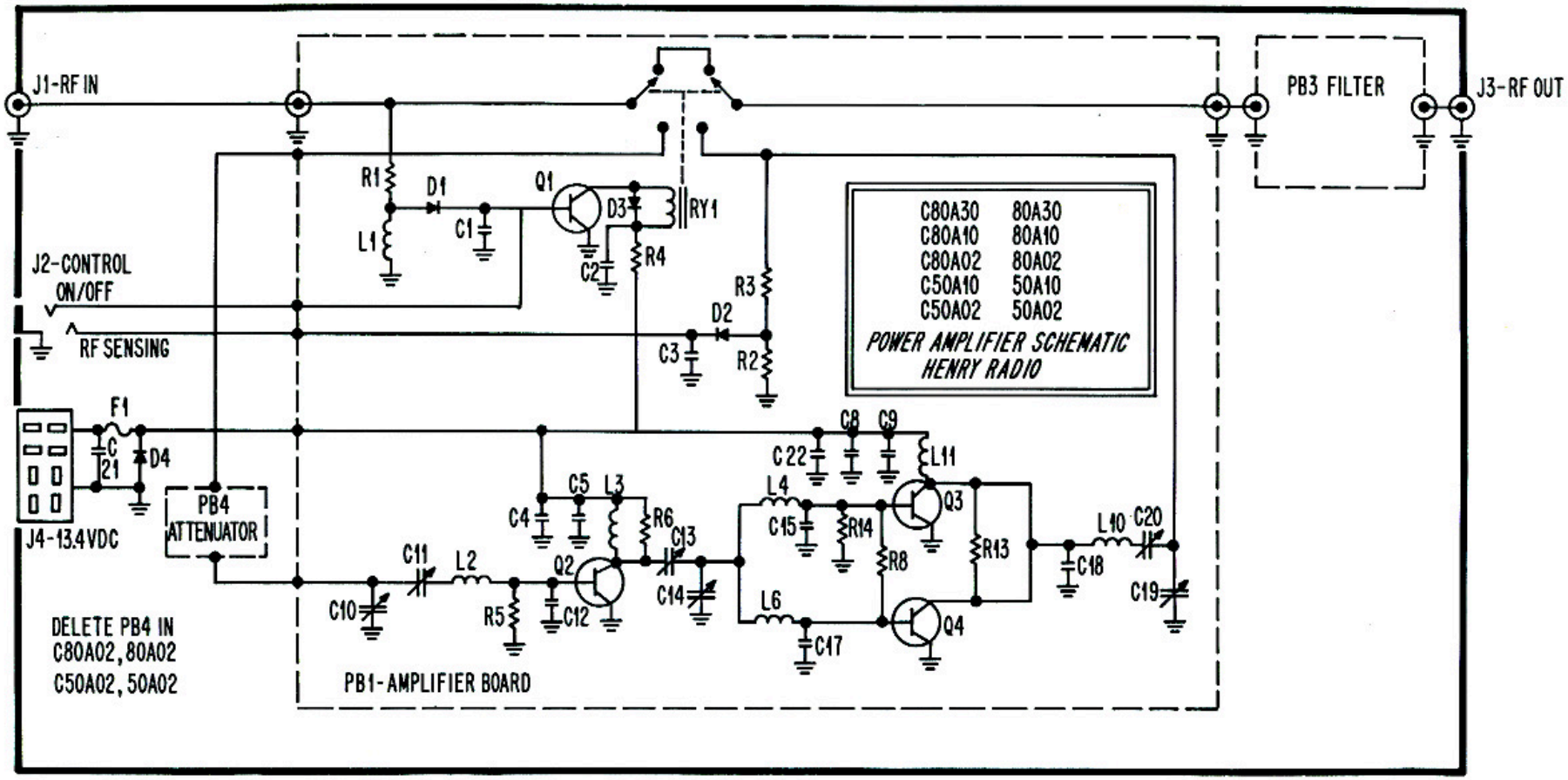
The power input or output of these amplifiers can be adjusted by tuning C13 for the desired power. Transmit into a proper load with a thruline wattmeter inserted in the output of the amplifier. Adjust C13 until the amplifier is operating at the maximum level desired.

Input power to the final stage can be calculated by measuring the DC current to the drive stage.

Power Input (watts) = 13.8 VDC x (total amplifier current - driver current.)

HENRY RADIO

LOS ANGELES, CA



C1, C2, C3, C4, C8	Ceramic disc capacitor, .05 MF, 20 volt - Centralab UK20-503.
C5, C21, C22	Ceramic disc capacitor, .001 MF, 1000 volt - Centralab DD -102.
C9	Electrolytic capacitor, 25 MF, 50 volt - Arco RME/FJ/025.
C10, C11, C13, C14, C19, C20	Ceramic trimmer capacitor, 7 - 100 pf, 350 volt - Arco 423.
C12, C15, C17	Mica chip capacitor, 200 pf - Unelco T101 - 200.
C18	Mica chip capacitor, 75 pf - Unelco J101-75.
D1, D2	Silicon signal diode, 1N4148.
D3	Silicon rectifier diode, 1 amp, 400 PIV - 1N4004.
D4	Silicon rectifier diode, 3 amp, 100 PIV - HEP - R0091.
F1	3AG, 25 amp fuse.
J1, J3	UHF type coaxial jack - Amphenol SO -239.
J2	3/16" stereo phono jack - Switchcraft S-12B.
J4	8 pin Jones plug - Cinch S308CCT.
L1	RF choke, 3.3 uh - Miller 9250 -332
L2, L3, L4, L6, L7, L9, L10, L11	Printed Circuit Inductors.
PB1	80A02 Circuit Board.
PB3	Low Pass Filter Board.
PB4	Attenuator Board C80A10, 80A10, C50A10, 50A10.
PB4A	Attenuator Board C80A30, 80A30.
Q1	RF amplifier transistor - 2N2222.
Q2 (50A models)	RF power transistor - CTC B12 -12.
Q2 (80A models)	RF power transistor - CTC B25 - 12.
Q3, Q4 (50A models)	RF power transistor - CTC B25-12.
Q3, Q4 (80A models)	RF power transistor - CTC B40-12.
R1, R2	Carbon resistor, 1 K ohm, 1/2 watt, 10%.
R3	Carbon resistor, 10 K ohm, 1/2 watt, 10%.
R4, R8, R13 (50A models)	Carbon resistor, 10 ohms, 1 watt, 10%.
R4, R8, R13 (80A models)	Carbon resistor, 2.7 ohms, 1/2 watt, 10%.
R5, R6	Carbon resistor, 5.1 ohm, 1 watt, 5%.
R14 (50A models)	Carbon resistor, 10 ohm, 1/2 watt, 10%.
R14 (80A models)	Carbon resistor, 2.7 ohm, 1/2 watt, 10%.
RY1	Changeover relay - Potter & Brumfield, R10-E1-42.